

REMARKS/ARGUMENTS

Status of Application

Claims 1-30 are pending (claims 27-30 are new).

Information Disclosure Statement

The Examiner has refused to make of record a number of Japanese references where only the English abstract was provided. In order that these references be made of record, Applicant is submitting complete versions of four documents, three of which have translations. Applicant respectfully requests that the Examiner make these four references of record.

Claim Amendments

Claim 16 is being amended to add a colon and introduce paragraph breaks for easier reading. This Amendment does not change the scope of the claim or add new matter.

Claims 27-30 are being added to more fully claim the invention. No new matter is being added.

Prior Art Rejection

The claims have been rejected as anticipated by Ishizumi (EP-A-0683249), or as obvious in view of Ishizumi, alone or in combination with Oki (JP-58125698). Applicant has carefully considered the Examiner's position with respect to these references, and respectfully requests reconsideration and withdrawal of the prior art rejections.

Ishizumi Does Not Anticipate Claim 1 or Render Claim 1 Obvious

Claim 1 recites, in pertinent part:

1. A method ... comprising separately heating precursors, at least two of which have different decomposition temperatures, to their respective decomposition temperatures at or adjacent a region of the substrate

Ishizumi fails to disclose every element recited in claim 1, and therefore cannot anticipate claim

1. As can be seen from the above claim excerpts, claim 1 requires:

1. that at least two of the precursors have *different* decomposition temperatures,
2. the precursors be heated to their *respective* decomposition temperatures, and

3. the heating of the precursors occur at or adjacent a region of the substrate.

In Ishizumi, the substrate holder 5 has a built in electric heater which generates heat. As is explained in the paragraph spanning columns 8 and 9, the heater allows the entire area of the substrate holding surface to be *uniformly maintained* at a *specified temperature*. There is no suggestion of heating the precursors to separate respective decomposition temperatures. Rather, the precursors would be heated to the same specified temperature due to maintaining the substrate at that temperature.

Therefore, the Examiner is respectfully requested to withdraw the anticipation rejection to claim 1. Moreover, Ishizumi does not contain any suggestion to heat the different precursors to respective different temperatures, so Ishizumi cannot be considered to render claim 1 unpatentable for obviousness.

Dependent claims 2-15, 27, and 28 are by their terms narrower than claim 1, and for at least that reason are also patentable.

Ishizumi In Combination with Oki Does Not Render Claim 16 Unpatentable

Claim 16 recites, in pertinent part:

16. Apparatus ... comprising:
... the first and second precursors having different decomposition temperatures;
first and second heating means for separately heating the first and second precursors to their respective decomposition temperatures at or adjacent a region of the substrate

As discussed above, Ishizumi fails to disclose or suggest heating the precursors to separate respective decomposition temperatures. However, Oki does show heating one of the precursors with a separate heating element 7 disposed in heating chamber 7' through which the gas passes before reaching the substrate which is heated by heating RF coil 3.

The Examiner has based an obviousness rejection on the combination of Ishizumi and Oki, which could, for the sake of argument be considered, in the aggregate, to show heating precursors to different temperatures (Oki) at or near the substrate (Ishizumi). However, Applicant respectfully submits first, that one of ordinary skill in the art ("OOOSITA") would not be led to combine the two references, and second, even if OOOSITA were to try to combine the teachings, the result would not be the claimed invention.

Turning to the first point, it is noted that Oki and Ishizumi illustrate two *mutually exclusive* methods of depositing semi-conductor materials, namely Metal Organic Vapour Phase Epitaxy (MOVPE) as described in Oki, and Atomic Layer Epitaxy (ALE) as described in Ishizumi. The MOVPE approach relies upon the mixing of precursors in the gaseous phase above the substrate. In contrast, ALE requires that there is no such mixing and rather that the species are supplied to the substrate individually. Thus, OOOSITA starting with Ishizumi and faced with the problem of improving the efficiency of the decomposition process, would in reality *only* consider other documents *relating to ALE*. Applicant does not believe that such a person would be led to consult the alternative field of MOVPE which cannot produce substrates of a similar form. Rather, to the extent that OOOSITA were to try to improve the decomposition efficiency, Applicant believes that this would be addressed by seeking to improve the gas flow properties in Ishizumi, or the use of difference precursors.

However, if we assume for the sake of argument that OOOSITA were to consult such separate fields and try to combine the teachings of Ishizumi and Oki, we also must ask what such a combination would look like.

Starting at Ishizumi, were the idea of using a separate heating element (such as element 7) selected from Oki, used in the apparatus of Ishizumi, it would be necessary to position this element *at best* in a location adjacent to the input ports 2 or 3 of the chamber 1 of Ishizumi (due to the moving partition 6). In doing so, this modification would not arrive at the present invention since the method of claim 1 requires the respective decomposition of the precursors "*at or adjacent*" a region of the substrate. As recognised by the present application, it is the close proximity of the decomposition positions to the substrate which provides one of the significant advantages over the prior art, since the precursors are highly reactive and this reduces the time during which they can recombine. This is neither taught nor suggested by Ishizumi.

It should also be understood that this "at or adjacent" requirement is not known from Oki. Oki is MOVPE apparatus and as such requires the *mixing* of gases above the substrate. This should be remembered when interpreting the drawings of Oki.

Returning to Ishizumi, the teaching is that the gas flow properties within the chamber are extremely important in order to ensure a smooth and non-turbulent gas flow. For

example the apparatus is designed to prevent convection (see column 10, line 46) and a constant gap is provided around the circumference of the substrate holder to ensure a smooth gas flow to the exhaust port. These features are crucial to the successful operation of the Ishizumi apparatus. OOOSITA would therefore be extremely unlikely to contemplate making any change to the internal configuration of such a chamber.

In Ishizumi, the substrate is spaced a significant distance from the inlet ports so as to produce the desired gas flow properties. At first sight this may seem of little consequence but it is vital to maintain a controlled gas flow. It is entirely against the teaching of this document to reduce such a distance to the extent such that the decomposition could be said to be adjacent to the surface of the substrate.

There are two specific reasons why such a modification would *not* be attempted. First, the inlet port would need to be redesigned and the gas flow dynamics reconsidered in order to produce a similar resultant deposition quality. It is certainly not clear how this would be achieved. Second, it should be recognized that by bringing the substrate closer to the inlet equipped with a heating element, during operation, such a substrate would also necessarily be brought close to the inlet port of the other precursor (for example inlet 3). This would be highly undesirable since again, not only would the gas flow dynamics be destroyed, but the gas entering the chamber through the inlet 3 would be at a significantly different temperature. This would result in a serious cooling effect upon the substrate (which is otherwise heated in D3 by the substrate holder).

Therefore, Applicant respectfully submits that it would not have been obvious to combine the teachings of Ishizumi and Oki, or that any such combination, improbable though it may be, could lead to the invention in an obvious manner. Therefore, it is respectfully submitted that claim 16 is patentable.

Dependent claims 17-26, and 29 are by their terms narrower than claim 16, and for at least that reason are also patentable.

Although the above remarks have been directed at independent apparatus claim 16, which was the subject of the combination rejection, Applicant submits that the remarks



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would apply to independent method claim 1. The remarks also apply to new independent apparatus claim 30, which recites an additional element.

CONCLUSION

In view of the foregoing, Applicant believes all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,

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